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Indian Standard

GENERAL REQUIREMENTS AND TESTING OF LIFEBOATS FOR LESS THAN ONE HUNDRED PERSONS

(First Reprint OCTOBER 1983)

UDC 629·125·5·001·4

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 4

July 1968

Indian Standard

GENERAL REQUIREMENTS AND TESTING OF LIFEBOATS FOR LESS THAN ONE HUNDRED PERSONS

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Indian Standard

GENERAL REQUIREMENTS AND TESTING OF LIFEBOATS FOR LESS THAN ONE HUNDRED PERSONS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 17 April 1968, after the draft finalized by the Marine Instruments and Safety Aids Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 Lifeboat construction, testing and periodical inspections are covered by International Convention and Statutory Rules of the country.

0.3 This standard covers the requirements of the International Convention on Safety of Life at Sea, 1960.

0.4 This standard is based on the ISO Recommendation R 338-1963 'Lifeboats for less than one hundred people' issued by the International Organization for Standardization.

0.5 This standard generally incorporates the requirements under the Merchant Shipping Act, 1958 and the rules made thereunder and in addition general requirements and testing of lifeboats is subject to the approval by the Government of India under the said Act and Rules.

---

1. SCOPE

1.1 This standard gives the general requirements and tests for lifeboats with carrying capacity less than 100 persons.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply (*see also* Fig. 1 to 4).

2.1 Lengths of Lifeboat

2.1.1 *Regulation Length, L*—This denotes the length of the boat in metres measured from the intersection of the outside of planking or plating at the stem to the corresponding point at the stern post or, in the case of a square-sterned boat, to the afterside of the transom. The regulation length is measured for the purpose of marking and measurement of cubic capacity as obtained from **3.1**.

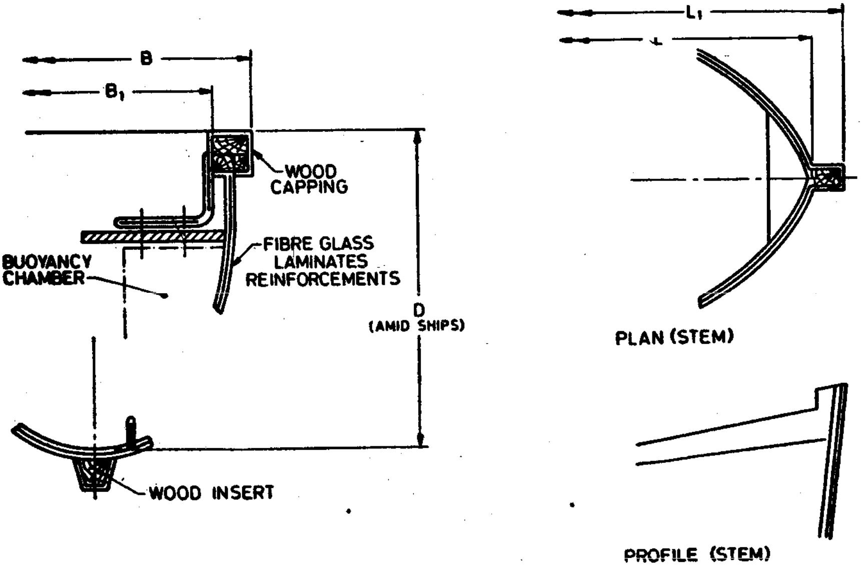

FIG. 1 FIBRE GLASS REINFORCED PLASTIC LIFEBOATS

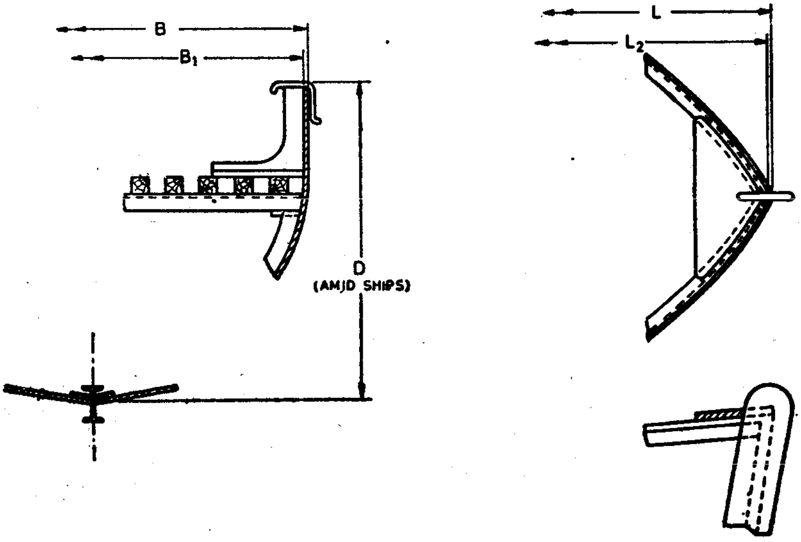

FIG. 2 STEEL AND ALUMINIUM LIFEBOATS

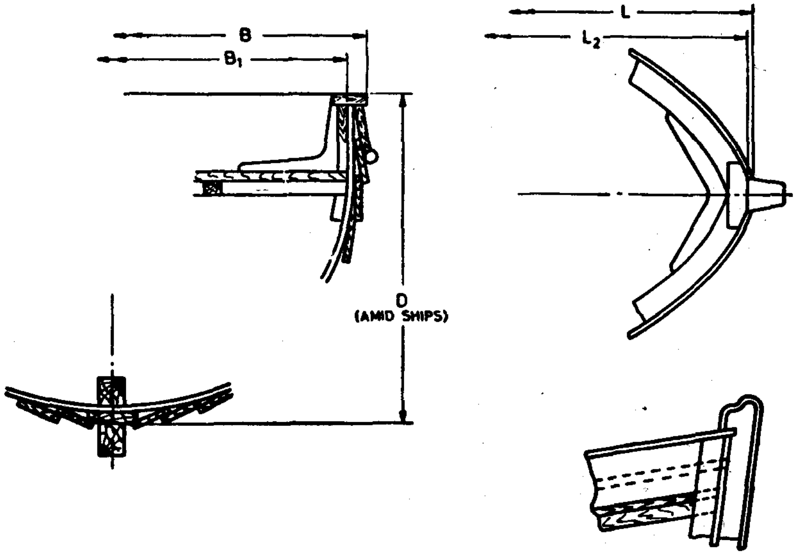

FIG. 3 WOODEN LIFEBOATS

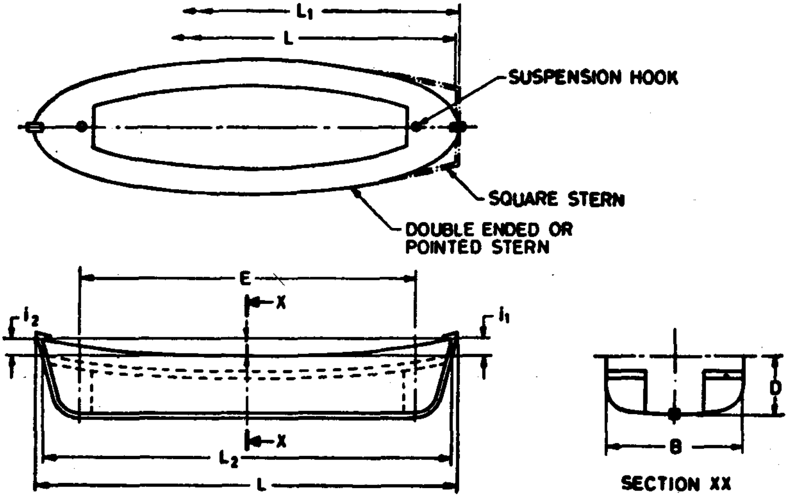

FIG. 4 GENERAL DIMENSIONS FOR LIFEBOATS

2.1.2 *Overall Length, L_1* — This denotes the length of boat in metres, measured from the forward edge of the stem post to the afteredge of the stern post or, in the case of a square-sterned lifeboat, to the afteredge of the transom, whichever is greater. The dimensions for this length are the maximum dimensions.

2.1.3 *Internal Length, L_2* — This denotes the length of boat in metres, measured from the inside of the planking or plating at the stem to the corresponding point at the stern post. In the case of a square-sterned lifeboat, the length is measured to the inside of the transom.

2.2 Breadths of Lifeboat

2.2.1 *Regulation Breadth, B* — This is also referred to as 'outer breadth' and denotes the breadth of the boat in metres, measured from the outside of the planking or plating at the point where the breadth of the lifeboat is greatest.

2.2.2 *Internal Breadth, B_1* — This denotes the breadth of the boat in metres when measured from the inside of the planking or plating at the point where the breadth is greatest.

2.3 Depth of Lifeboat

2.3.1 *Depth, D* — This denotes the depth of the lifeboat in metres when measured amidships inside the planking or plating from the keel to the level of the gunwale, but the depth used in calculating the cubic capacity may not in any case exceed 45 percent of the breadth.

2.4 Double Ended Boat — This refers to a lifeboat with both ends pointed.

2.5 Square Stern Type — This refers to a lifeboat having a transom stern.

2.6 Block Coefficient of Cubic Capacity — This is the ratio of the cubic capacity of displacement of the lifeboat to the volume of a block having the same length, extreme breadth and mean loaded draught of the vessel.

2.7 Sheer — This is the longitudinal curvature in parabolic form of the level of gunwale in profile. The height of sheer is measured from the level of gunwale to a line of reference drawn parallel to the keel through the sheer line at mid length.

3. GENERAL REQUIREMENTS

3.1 Form, Proportions and Other Requirements for Lifeboats

3.1.1 The block coefficient of cubic capacity of the lifeboat when measured shall not be less than 0·64, except for wooden lifeboats made of planks, for which the ratio may be replaced by 0·60.

3.1.2 The cubic capacity shall be determined by sterling (Simpson's) rule or by any other method giving the same degree of accuracy (*see* Appendix A). The cubic capacity of square-sterned lifeboat shall be calculated as if the lifeboat was a double-ended one (pointed stern).

The cubic capacity of the lifeboat shall be determined by exact measurement or may be assumed to be the product of length, breadth and depth multiplied by 0·60 for wooden lifeboats, provided that this does not give a greater capacity by exact measurement.

For ascertaining the exact cubic capacity of a wooden lifeboat, the length *L*, and breadth *B*, as defined in **2.1.1** and **2.2.1** respectively, shall be used.

For ascertaining the exact cubic capacity of steel, aluminium and glass reinforced plastic lifeboats, the length and breadth as defined in **2.1.3** and **2.2.2** shall be used.

3.1.3 If the depth *D* of the lifeboat amidships exceeds 45 percent of the breadth:

a) the depth employed in calculating the area of the amidships cross-section shall be deemed to be equal to 45 percent of the breadth.

b) the depth employed in calculating the areas of the quarter length sections (from the bow and stern) is obtained by increasing the depth employed under (a) above by an amount equal to one percent of the length of the lifeboat, provided that in no case shall the depth employed in the calculation exceeds the actual depth at these sections.

3.1.4 If the depth *D* of the lifeboat is greater than 1·22 m the number of persons to be certified to be accommodated in the boat by the application of this Rule, shall be reduced in proportion to the ratio of 1·22 m to the actual depth until the lifeboat has been satisfactorily tested afloat with the number of persons on board all wearing life jackets.

3.1.5 The cubic capacity of a motor lifeboat or a lifeboat fitted with other propelling gear shall be obtained from the gross capacity by deducting a volume equal to that occupied by the motor and its accessories or the gear box of the other propelling gear and, when carried, the radiotelegraph installation and searchlight with their accessories.

3.2 Sheer — All lifeboats shall have a mean sheer equal to at least four percent of their length *L*.

3.3 Buoyancy

3.3.1 *Oar Propelled and Mechanically Propelled Boats*

3.3.1.1 All lifeboats shall have sufficient inherent buoyancy, or should be fitted with watertight air cases or other equivalent non-corrodible buoyant material which shall not be adversely affected by oil or oil products. The air cases or buoyant material shall be sufficient to float the boat and its equipment when the boat is flooded and open to the sea.

3.3.1.2 An additional volume of watertight air cases or other equivalent non-corrodible buoyant material which shall not be adversely affected by oil or oil products equal to at least 10 percent of the cubic capacity of the boat shall be provided. The watertight air cases may be filled with a non-corrodible buoyant material which shall not be adversely affected by oil or oil products.

3.3.1.3 The mass of metallic materials in a lifeboat shall be subject to compensation (for example, devices for mechanical propulsion, metal hull, accessories other than those normally found in wooden boats). For this purpose, in order to comply with **3.3.1.1**, the internal buoyancy required by **3.3.1.2** shall be increased by an additional volume.

As an indication, the value of this additional volume is equal to the weight multiplied by a factor given by the following table:

Material	*Metric Units* dm^3/kg
Iron and steel	1
Aluminium and its alloys	0·76
Glass-reinforced plastics	0·50*

3.3.1.4 If the volume of the air cases or buoyant material provided complying with **3.3.1.2** exceeds the volume resulting from the actual number of persons permitted on board, the excess volume may be used as compensation for the metal parts of the hull, the devices for mechanical propulsion, etc, with the agreement of the competent national organization.

3.3.2 Motor Boats — On motor lifeboats the volume of the air cases or internal buoyancy compartments shall be increased, to the extent needed to compensate for the difference between:

a) the motor, its accessories and, where applicable, the searchlight, radiocommunication installation and their accessories; and

b) the weight of the additional number of persons which the lifeboat could take if the motor, its accessories and, where applicable, the searchlight and the radiocommunication installations were removed.

This compensation is effected by increasing the volume of the internal buoyancy by 1 dm^3 per kilogram of the metallic material in the propelling gear (including shaft lines and propeller and, where applicable, the searchlights and radio-communication installation) and by subtracting from the volume of the internal buoyancy 28·3 dm^3 per extra person which the lifeboat could take if the propelling apparatus and its related installations (including the searchlight and radio-communication installation) were removed.

---

*The figure 0·50 is applicable in the case of plastics the mass density of which is less than 1·6 kg/dm^3.

3.4 Freeboard when loaded — The minimum freeboard when loaded shall be not less than six percent of the regulation length of the boat and not less than 0·44 D (where D is the depth).

The freeboard may also be obtained from the following formula:

$$F = \frac{2{\cdot}8\ NB^2}{\Delta h}$$

where

F = freeboard in metres,
N = number of persons in the boat,
B = breadth of boat in metres,
Δ = displacement of water in kg, and
h = initial metacentric height in metres.

3.5 Stability — All lifeboats shall be properly constructed and shall be of such form and proportions that they shall have ample stability in a seaway, and sufficient freeboard when loaded with their full complement of persons and equipment.

3.5.1 The minimum metacentric height (GM) of the upright boat, fully loaded, without shipped water, shall not be less than that given by the following formula:

$$GM = 0{\cdot}05\ B^2 - 0{\cdot}05\ B + 0{\cdot}20 \text{ (in metres)}$$

where B is the outer breadth as defined in **2.2.1**.

3.5.2 All lifeboats shall be capable of maintaining positive stability when open to the sea and loaded with their full complement of persons and equipment.

3.5.3 The stability after swamping (for instance, 10 percent of the cubic capacity) shall be taken into consideration and for this purpose, the lines of the boat and the arrangement of the air cases or internal buoyancy compartments shall be taken into account.

3.5.4 The air cases or internal buoyancy compartments should be arranged close to the side in order to obtain, to the fullest possible extent, maximum stability in the event of swamping.

3.5.5 The distance between the watertight air cases or internal buoyancy compartments as well as the gap between the cases and the planking should be kept to a minimum.

3.5.6 Air cases or internal buoyancy compartments may, however, be permitted at the ends, but none shall be installed in the bottom.

3.6 Number of Persons Permitted on Board — Calculations are made on the assumption that the weight of one person is 75 kg. The number of persons to be allowed into the lifeboat is determined by the conditions below, occurring simultaneously:

a) The number shall not exceed the greatest whole number obtained by dividing the cubic capacity:

By 0·283, where the capacity is measured in cubic metres	In the case of lifeboat of 7·3 m in length or over;
By 0·396, where the capacity is measured in cubic metres	In the case of lifeboats of 4·9 m in length;
By a number to be obtained by interpolation, between 0·396 and 0·283, where the capacity is measured in cubic metres	In the case of lifeboats of over 4·9 m in length but under 7·3 m

b) That number shall enable the persons to take their seats wearing their life-jackets. Instead of a seating test, the number for which seating is provided may be obtained by allowing a minimum of 0·46 m for each person, measured on the edge of his seat, adequate space being allowed for the legs of each person.

c) It shall give a satisfactory result in the stability test.

d) It shall not interfere with the use of the oars, which includes the handling of the steering oar and the tiller, or with the operation of other propulsion equipment.

3.6.1 The maximum number of persons authorized shall be at least that derived from (a) and (b) in **3.6** subject to the volume of internal buoyancy being available for that number of persons as derived from **3.3** duly compensated for metal hull, propelling gear, etc, or the number of persons as derived from **3.3** and **3.6**, whichever is minimum.

3.6.2 The maximum number of persons authorized according to **3.6.1** shall be indelibly marked on the lifeboat (*see* **7.1**).

4. CONSTRUCTION

4.1 Rules of Construction — The construction should comply with the requirements of this standard. The dimensions of standard boats is given in **8.2** as a guide.

4.1.1 No lifeboat shall exceed 20 300 kg in weight when fully loaded with persons and equipment.

4.1.2 All lifeboats meant to carry more than 60 persons shall be either mechanically propelled or motor lifeboats according to **4.5** and **4.6**.

4.1.3 All lifeboats shall be of sufficient strength to enable them to be safely lowered into the water when loaded with their full complement of persons and equipment.

4.2 Seats — All thwarts and the side-seats should be as low in the lifeboat as practicable and the recommended minimum values from the gunwale are:

Size of Lifeboat metres	*Depth Below the Gunwale* mm
7·3 and under	230·0
Over 7·3 to 8·5	250·0
Over 8·5 to 9·5	280·0

4.3 Suspension and Release Devices — The hooks and the release devices shall have a safety factor of 6 against breaking load.

Arrangements should be made for speedily, but not necessarily simultaneously, detaching the lifeboats from the two falls.

The point of attachment of the lifeboats to the falls shall be at such height above the gunwale as to ensure stability when lowering the lifeboats (for instance, 12·5 cm).

4.4 Protection Against Corrosion — All steel parts used in the construction shall be hot-galvanized in accordance with IS:2629-1966* or receive equivalent protection against corrosion.

4.5 Mechanically Propelled Lifeboats — It is mandatory for lifeboats carrying more than 60 persons (types P3, P4 and P5 according to Table 2) to have man-powered (or motor, *see* **4.6**) mechanical propulsion. The hand propelling gear shall have sufficient power to enable the lifeboat to be readily cleared from the ship's side, when launched, and to be able to hold course under adverse weather conditions. The lifeboat with full load shall be capable of covering ahead 150 m in two minutes, from a standing start, in calm water.

4.5.1 If the propelling gear is manually operated it shall be capable of being worked by persons untrained in its use and it shall also be capable of being operated when the lifeboat is flooded.

4.5.2 A device shall be fitted by means of which the helmsman can cause the lifeboat to go astern at any time when the propelling gear is in operation.

4.5.3 The compensation for the mass of the propelling gear shall be according to **3.3.1.3**.

4.6 Motor Lifeboats

4.6.1 A motor lifeboat shall comply with the following conditions.

4.6.1.1 It shall be fitted with a compression ignition engine and kept so as to be at all times ready for use; it should be capable of being readily started in all conditions; sufficient fuel for 24 hours continuous operation at the speed specified in **4.6.1.3** shall be provided.

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*Recommended practice for hot-dip galvanizing of iron and steel.

4.6.1.2 The engine and its accessories shall be suitably enclosed to ensure operations under adverse weather conditions, and the engine's casing should be fire-resisting. Provision should be made for going astern.

Pipes for the intake and the overboard discharge from the engine shall be suitably connected and protected between the engine casing and the hull to avoid accidental flooding.

4.6.1.3 The speed ahead in smooth water when loaded with its full complement of persons and equipment shall be:

a) at least 6 knots, in the case of motor lifeboats required to be carried in passenger ships, tankers, ships employed as whale factory ships, ships employed as fish processing or canning factory ships and ships engaged in the carriage of persons employed in the whaling, fish processing or canning industries; and

b) at least 4 knots, in the case of any other motor lifeboat.

4.6.2 The volume of the airtight compartments shall be according to **3.3.2**.

4.6.3 Motor lifeboats may be fitted with means for preventing the entry of water and spray at the fore-end.

5. EQUIPMENT

5.1 Arrangements shall be made by the builder to allow for fitting the equipment as specified in IS:3586-1966*.

5.2 All lifeboats shall be fitted with suitable means to enable persons in the water to climb into the lifeboats. They shall also be provided suitable becket lines together with floats, around the gunwale.

5.3 A plug hole with properly fitting plugs, secured by chains, shall be provided at the bottom of the boat. Alternatively, automatic draining plugs may be provided.

6. TYPE TEST

6.1 The prototype boats shall pass the following tests.

6.1.1 *Strength Test*—The strength test shall be carried out as detailed in this clause. The lifeboat shall be suspended by its hooks, in the fully loaded state, with an overload equal to 25 percent of the total weight of the lifeboat, passengers and gear, distributed over the whole boat. The boat in this condition shall be sighted for deflection, which shall not, as a rule exceed 1/400 part of the regulation length of the lifeboat. The transverse deflection shall also be measured. After removal of the load, the lifeboat shall again be sighted for deflection in both longitudinal and transverse directions. The lifeboat shall be considered to have passed the strength test if there is no residual deflection.

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*Recommendations for lifeboats equipment.

6.1.2 In the case of glass reinforced plastics, time interval for recovering is permissible. Special tests may be required for glass reinforced plastic lifeboats particularly with regard to overload and the use of a drop test.

6.1.3 *Inclining Test*—An inclining test shall be carried out. The actual metacentric height obtained from the test shall be greater than the value obtained from **3.5.1**.

6.2 Test Afloat with Full Load

a) This test is to verify that the arrangement of the persons does not in any way hinder the operation of the oars or of the manpowered mechanical propulsion unit or of the motor or of the fixed radio installation if fitted.

b) The persons taking part in this test will be adults, wearing life-jackets.

c) This test is at the same time a buoyancy test which is used to verify the free board and the draughts.

d) The lifeboat shall remain afloat for a suitable period to exhibit its watertightness.

6.3 Operational Test—This test is for checking the efficient operation of the mechanical propulsion devices or of the motor. Propulsion test of the lifeboat is to verify the operation of the propulsion gear defined in **4.5** and **4.6** fully loaded and with only a launching crew, in the launching condition.

7. MARKING

7.1 The dimensions *L*, *B* and *D* of a lifeboat and the number of persons which it is permitted to carry shall be permanently cut in clear characters and the marking shall be completed for the purpose of identification by addition of the inspecting authority's initials with date.

8. CHARACTERISTICS OF LIFEBOATS (CAPACITY, DIMENSIONS, STABILITY)

8.1 Table 1 gives the symbols for various types of lifeboats classified according to material used and the type of propulsion used (*see* Fig. 4).

TABLE 1 SYMBOLS FOR VARIOUS TYPES OF LIFEBOATS

(*Clause* 8.1)

MATERIAL (1)	CLASSIFICATION (2)	SYMBOL (3)
Wood	Rowing lifeboat	WR
	Mechanical gear	WG
	Motor lifeboat	WM_4* WM_6*
Steel	Rowing lifeboat	SR
	Mechanical gear	SG
	Motor lifeboat	SM_4* SM_6*
Aluminium alloy	Rowing boat	AL R
	Mechanical gear	AL G
	Motor lifeboat	AL M_4* AL M_6*
Fibre glass	Rowing boat	GRP (R)
	Mechanical gear	GRP (G)
	Motor lifeboat	GRP (M_4*) GRP (M_6*)

*M_4 and M_6 represent motor lifeboat of 4 and 6 knots speed respectively.

8.2 Table 2 indicates the capacity, dimensions and stability details of lifeboats (*see* Fig. 4).

TABLE 2 CAPACITY, DIMENSIONS AND STABILITY DETAILS OF LIFEBOATS

(*Clauses* 4.5, 8.2 and *Fig.* 4)

MARK	*Max*, NO. OF PERSONS	CAPACITY	REGULATION LENGTH	RATIOS		DISTANCE OF SUSPENSION	*Min*, STABILITY	SHEER	OUTER BREADTH
	N	C	L	L/B	L/D	E	GM	a	B
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		m^3	m			m	m	m	m
L1	10	3·960	4·900	2·800	6·900	4·000	0·270	0·200	1·750
L2	14	5·150	5·500	2·900	7·300	4·450	0·285	0·220	1·900
L3	19	6·500	6·000	2·900	7·400	4·850	0·310	0·240	2·050
L4	25	8·000	6·600	2·950	7·600	5·250	0·330	0·260	2·200
L5	33	9·800	7·000	3·050	7·700	5·700	0·350	0·280	2·300
M1	40	11·320	7·300	3·050	7·700	6·000	0·370	0·295	2·400
M2	47	13·300	8·000	3·150	8·000	6·600	0·395	0·320	2·550
M3	55	15·570	8·500	3·150	8·100	7·000	0·430	0·340	2·700
P1	48	13·600	7·300	2·750	6·900	6·000	0·420	0·295	2·650
P2	60	17·000	8·000	2·800	6·900	6·600	0·465	0·320	2·850
P3	73	20·700	8·500	2·800	7·000	7·000	0·510	0·340	3·050
P4	85	24·100	9·000	2·800	7·000	7·450	0·550	0·360	3·200
P5	99	28·100	9·500	2·800	7·000	7·850	0·595	0·380	3·350

NOTE 1 — $N =$ Maximum number of persons. The number applies to rowing lifeboats or mechanically propelled lifeboats; this number shall be reduced in the case of motor lifeboats.

NOTE 2 — The indicated cubic capacity is a minimum.

NOTE 3 — $E =$ Distance between the suspension $- 0{\cdot}86L - 0{\cdot}30$ (in metres), except when the suspensions are fixed at the ends of the lifeboats. Tolerance on E is $\pm$ 2 percent.

NOTE 4 — GM *Min* $= 0{\cdot}05\,B^2 - 0{\cdot}05\,B + 0{\cdot}20$ (in metres).

NOTE 5 — $a =$ Sheer $= \frac{i_1 + i_2}{2}$ (in metres). The sheer should be equal to at least 4 percent of the regulation length L.

NOTE 6 — The approximate mass of the lifeboats (mentioned as an indication) is calculated with equipment and passengers (unit mass = 75 kg).

NOTE 7 — The small lifeboats of less than 7·30 m may only be used with agreement of the national organization.

NOTE 8 — The lifeboats P_1 and P_2 can be rowing lifeboats or mechanically propelled lifeboats. Lifeboats for more than 60 persons shall be mechanically propelled lifeboats or motor lifeboats.

NOTE 9 — These numbers of persons are subjected to the restriction of 3·6 (provisional limitations to 83 and 93 persons).

APPENDIX A

(*Clause* 3.1.2)

CUBIC CAPACITY MEASUREMENT OF LIFEBOAT BY STIRLING'S (SIMPSON'S) RULE

A-1. The capacity of the lifeboat in cubic metres can be calculated by the following Stirling's Rule:

$$\text{Capacity} = \frac{L}{12}\,(4A + 2B + 4C)$$

L being the length of the lifeboat in metres from the inside of the planking or plating at the stem to the corresponding point at the stern post: in the case of a lifeboat with a square stern, the length is measured to the inside of the transom. A, B, C denote respectively the areas of the cross-sections at the quarter-length forward, amidships, and the quarter-length aft, which corresponds to the three points obtained by dividing L into four equal parts. (The areas corresponding to the two ends of the lifeboat are considered negligible.)

A-2. The areas A, B, C shall be deemed to be given in square metres by the successive application of the following formula to each of the three cross-sections:

$$\text{Area} = \frac{h}{12}\,(a + 4b + 2c + 4d + e)$$

h being the depth measured in metres inside the planking or plating from the keel to the level of the gunwale, or, in certain cases, to a lower level as determined hereafter. a, b, c, d, e denote the horizontal breadths of the lifeboat measured in metres at the upper and lower points of the depth and at the three points obtained by dividing h into four equal parts (a and e being the breadths at the extreme point, and c at the middle point of h).

A-3. If the sheer of the gunwale, measured at the two points situated at a quarter of the length of the lifeboat from the ends, exceeds 1 percent of the length of the lifeboat, the depth employed in calculating the area of the cross-sections A or C shall be deemed to be the depth amidships plus 1 percent of the length of the lifeboat.

A-4. If the depth of the lifeboat amidships exceeds 45 percent of the breadth, the depth employed in calculating the area of the amidship cross-section B shall be deemed to be equal to 45 percent of the breadth and the depth employed in calculating the areas of the quarter length sections A and C is obtained by increasing this last figure by an amount equal to 1 percent of the length of the lifeboat, provided that in no case shall the depths employed in the calculation exceed the actual depths at these points.

A-5. If the depth of the lifeboat is greater than 1·220 metres, the number of persons given by the application of this Rule shall be reduced in proportion to the ratio of 1·220 metres to the actual depth, until the lifeboat has been satisfactorily tested afloat with that number of persons on board, all wearing life-jackets.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

INDIAN STANDARDS INSTITUTION

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002

Telephones : 26 60 21, 27 01 31

Telegrams : Manaksanstha

Regional Offices:

			Telephone
Western	: Novelty Chambers, Grant Road	BOMBAY 400007	89 65 28
Eastern	: 5 Chowringhee Approach	CALCUTTA 700072	27 50 90
Southern	: C. I. T. Campus	MADRAS 600113	41 24 42
Northern	: B69, Phase VII	S.A.S. NAGAR (MOHALI) 160051	8 78 26

Branch Offices:

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Printed at Seema Offset Press, Delhi, India